

# PETROLEUM ENGINEERING

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The petroleum engineering program offers courses of study leading to the masters of science, doctor of philosophy, or doctor of engineering degrees. The master's degree can be earned with either a thesis option or a non-thesis option.

While the program encourages students with an undergraduate degree in petroleum engineering to pursue graduate study, many graduate students are accepted with backgrounds in other areas of engineering, such as chemical engineering, mechanical engineering, or geological engineering. The program accepts such students with the expectation that any remedial petroleum engineering coursework will be met by the student while in residence for the master's degree. Students with backgrounds in geology or geophysics will also need to complete all fundamental engineering courses required for a degree in engineering.

Graduate students studying for a masters degree with a thesis option typically find support for their study depending on current research projects and the availability of funding. Students preferring the non-thesis option are typically self-funding for their masters degree.

Each student's graduate degree program is designed around a set of core petroleum engineering courses and other courses selected to support the thesis topic of interest. Students identify their thesis topic by the end of their first semester.

Research specialties of the petroleum engineering program include reservoir enhancement, hydraulic fracturing, CO<sub>2</sub> sequestration, gel treatments, drilling, well completion performance studies, and geomechanics of petroleum recovery.

The program emphasizes mechanical earth modeling (MEM) as a specialty. The MEM group owns part of the university numerical intensive computing cluster. Students with a strong background in geological engineering and geomechanics will likely find excellent opportunities for advanced studies.

The petroleum engineering laboratories contain modern equipment designed to study the many problems encountered in oil and gas production, as well as support research. The department laboratories include gas porosimeter and permeameter, liquid permeameter, viscometers, tensiometers, and a HPTP core flooding cell. The program also utilizes departmental facilities that include core cutting and preparation, laser ablation, XRD, SEM, and a triaxial and fracture cell and a direct shear apparatus for determining rock and fracture properties.

Students externally supported by international oil and gas operating companies may also suggest research topics related to their professional experience or special topics of interest to their companies.

For students whose native language is not English, a minimum score of 79 TOEFL, or a minimum score of 53 PTE, or a minimum score of 6.5 IELTS is required for admission. GRE scores are not required.

For additional information regarding graduate study opportunity contact [rocks@mst.edu](mailto:rocks@mst.edu). Additional information may also be found at the web pages at: <https://ggpe.mst.edu/> or <https://petroleum.mst.edu/>.

**Baojun Bai**, Professor and Lester R. Birbeck Chair  
PHD New Mexico Institute of Mining and Technology  
Conformance control, Enhanced Oil Recovery (EOR), numerical modeling and reservoir simulation, multiple-phase fluid flow in porous media, unconventional oil and gas development, carbon sequestration, and geothermal.

**David Carpenter**, Associate Teaching Professor<sup>1</sup>  
BSME University of Missouri, Columbia

**Shari Dunn Norman**, Associate Professor Emeritus  
PHD Heriot-Watt University

**Andreas Eckert**, Associate Professor  
PHD University of Karlsruhe  
Mechanical earth modeling, finite element methods in petroleum engineering, petroleum geomechanics and geophysics.

**Ralph E Flori Jr**, Associate Professor Emeritus  
PHD University of Missouri-Rolla

**Mingzhen Wei**, Associate Professor  
PHD New Mexico Tech  
Reservoir simulation, reservoir engineering, data modeling, data management, and advanced application development using artificial intelligence computation in the Petroleum Engineering.

**PET ENG 5000 Special Problems** (IND 0.0-6.0)  
Problems or readings on specific subjects of projects in the department. Consent of instructor required.

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**PET ENG 5001 Special Topics** (LEC 0.0-6.0)  
This course is designed to give the department an opportunity to test a new course. Variable title.

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**PET ENG 5010 Seminar** (RSD 0.0-6.0)  
Discussion of current topics.

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**PET ENG 5040 Oral Examination** (IND 0.0)  
After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D. students may be processed during intersession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/ written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

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**PET ENG 5050 Carbon Storage** (LEC 3.0)

This course provides an overview of CO<sub>2</sub> storage in subsurface from fundamental to applications. The topics include importance of store CO<sub>2</sub> in subsurface, CO<sub>2</sub> phase behavior, geologic reservoir storage, CO<sub>2</sub> enhanced oil recovery, CO<sub>2</sub> leakage monitoring and control, and field case studies.

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**PET ENG 5085 Internship** (IND 0.0-15)

Students working toward a doctor of engineering degree will select, with the advice of their committees, appropriate problems for preparation of a dissertation. The problem selected and internship plan must conform to the purpose of providing a high level engineering experience consistent with the intent of the doctor of engineering degree.

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**PET ENG 5099 Research** (IND 0.0-12)

Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required.

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**PET ENG 5801 Petroleum Data Analytics** (LAB 1.0 and LEC 2.0)

This course provides a general introduction to fundamental data analytics methods including basic statistical analysis, regression analyses and their applications in petroleum engineering, and their implementation using python, the most popular interpreted computer language. Prerequisites: Comp Sci 1500 and at least Junior standing.

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**PET ENG 6000 Special Problems** (IND 0.0-6.0)

Problems or readings on specific subjects of projects in the department. Consent of instructor required.

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**PET ENG 6001 Special Topics** (LAB 1.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

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**PET ENG 6010 Seminar** (IND 0.0-6.0)

Discussion of current topics.

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**PET ENG 6040 Oral Examination** (IND 0.0)

After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D. students may be processed during intersession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/ written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

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**PET ENG 6050 Continuous Registration** (IND 1.0)

Doctoral candidates who have completed all requirements for the degree except the dissertation, and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

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**PET ENG 6085 Internship** (IND 0.0-15)

Students working toward a doctor of engineering degree will select, with the advice of their committees, appropriate problems for preparation of a dissertation. The problem selected and internship plan must conform to the purpose of providing a high level engineering experience consistent with the intent of the doctor of engineering degree.

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**PET ENG 6099 Research** (IND 0.0-12)

Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required.

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**PET ENG 6100 Advanced Professional Geoscience Skills** (LEC 3.0)

Communication of complex research topics in the geosciences is required for successful post-doctoral career advancement in both academic and non-academic career paths. Best practices for developing and proposing scientific ideas in the geosciences will be critiqued weekly. Assessment of research proposals presentations includes peer-and self-evaluation. Prerequisites: Doctoral Graduate Standing. (Co-listed with Geology 6100).

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**PET ENG 6211 Advanced Directional Drilling and MWD** (LEC 3.0)

In-depth study of directional well planning and drilling. The course covers the bottom hole assemblies and operational techniques used in directional drilling as well as the limiting factors and hole problems related to horizontal wells. Advanced research topics and well design in directional drilling. Prerequisites: Pet Eng 4210.

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**PET ENG 6231 Drilling Optimization** (LEC 3.0)

Optimization of the drilling process based on geomechanical model of the subsurface. Topics include drilling hydraulics, drilling bits, selection of operational parameters and analysis of drilling time and cost. Prerequisite: Pet Eng 4210.

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**PET ENG 6431 Advanced Well Completion Design** (LEC 3.0)

Overview of hardware, fluids and processes employed in completing oil and gas wells. Types of well completions and design considerations. Downhole mechanics, tubing movement and stress calculations. Advanced concepts in well completion design and review of well completions literature. Prerequisites: Pet Eng 4410.

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**PET ENG 6441 Advanced Well Stimulation** (LEC 3.0)

This course builds on the basic theory and fundamentals of hydraulic fracturing through the use of STIMPLAN software and hands on industry examples. The course teaches the methods used to plan, execute and evaluate hydraulic fracturing treatments. An advanced exercise and a research assignment are required. Students may not earn credit for both Pet Eng 4441 and Pet Eng 6441. Prerequisites: Pet Eng 3520 and Pet Eng 3310.

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**PET ENG 6521 Advanced Well Test Analysis** (LAB 1.0 and LEC 2.0)

Pressure transient analysis equations, well test analysis for fractured wells, horizontal wells, injection wells, and other special situations. Introduction to rate transient analysis. Prerequisites: Pet Eng 3520 and Pet Eng 4520.

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**PET ENG 6541 Advanced Reservoir Engineering I** (LEC 3.0)

Advanced study of producing mechanisms. Prerequisites: Pet Eng 5631 and Pet Eng 4520.

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**PET ENG 6551 Advanced Reservoir Engineering II** (LEC 3.0)

Flow through porous media: derivations and solutions for steady, semi-steady, and transient flow of single and multiple phase flow through porous media. Prerequisite: Pet Eng 3520.

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**PET ENG 6621 Advanced Applied Reservoir Simulation** (LAB 1.0 and LEC 2.0)

Advanced simulation of reservoir problems using field and individual well models to determine well spacing, production effects of secondary and enhanced recovery processes, future rate predictions and recovery, coning effects, and more. The lab focuses on learning advanced computer simulations and pre- and post-processing techniques for big datasets. Prerequisite: Pet Eng 4621 or equivalent.

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**PET ENG 6631 A Survey Of Improved Recovery Processes** (LEC 3.0)

An overview of current advanced recovery methods including secondary and tertiary processes. An explanation of the primary energy mechanism and requirements of these methods and an analysis of laboratory results and their subsequent field applications. Prerequisite: Pet Eng 4611.

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**PET ENG 6711 Geodynamics** (LEC 3.0)

The applications of continuum physics to geological and petroleum engineering problems. Topics include plate tectonics, stress and strain in solids, elasticity and flexure, heat transfer, gravity, fluid mechanics, rock rheology, faulting, and flow in porous media. Prerequisites: Math 2222 and Geology 3310. (Co-listed with Geology 6211).

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**PET ENG 6801 Advanced Petroleum Data Analytics** (LAB 1.0 and LEC 2.0)

This course advances the general introduction to fundamental data analytics methods with their applications in engineering disciplines, including basic statistical analysis, regression analyses, artificial intelligence methods and their implementation using python, the most popular interpreted computer coding language. Prerequisites: Graduate standing with some coding experience.

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**PET ENG 6811 Advanced Offshore Petroleum Technology** (LEC 3.0)

A study of factors affecting offshore structural design and operation. Focus is on mobile offshore drilling units (MODUs). Subsea well systems and offshore pipelines are covered. Advanced topics in system design. Prerequisites: Pet Eng 4210, Civ Eng 3330, Civ Eng 2210.

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